

create a minimum magnetic field at the substrate.

29. (New) The apparatus, as recited in claim 2, wherein each of the plurality of magnetic elements extends substantially from said first end of said process chamber to said chuck.

REMARKS

Claims 1 and 19-25 have been cancelled. Claim 2 has been amended to be an independent claim with all of the limitations of claim 1. Claims 26 to 29 have been added.

The applicant confirms the election of group 1, claims 1-16 with traverse.

The Examiner rejected claim 1 under 35 U.S.C. 102, as being anticipated by Dandl (U.S. Patent 5,707,452). Claim 1 has been cancelled.

The Examiner rejected claims 2-7 and 12 under 35 U.S.C. 103 (a) as being unpatentable over Dandle.

Claim 2, as amended, recites that the magnetic elements are disposed around and extend along the plasma region. Page 10, lines 28 to 32, describe how the magnetic elements 702 in FIG. 2 extend along the plasma region, which is substantially from the chuck 314 to the window 308. In addition, page 17, lines 16 to 18, of the application further states that the magnetic elements 550 are disposed along the plasma region, referring to FIG 6. Here the magnetic elements are in a ring shape as disclosed in Dandl. Instead of stating that the rings extend along the plasma region, the application states that they are disposed along the plasma region. The magnets of Dandl may be disposed along the plasma region as shown in FIG. 6 of the present application, but none of the magnets in Dandl extend along the plasma region as recited in claim 2 and shown in FIG. 2 of the present application. Nothing in Dandl suggests magnets that extend along the plasma region. For these reasons, claim 2 is not made obvious by Dandl.

Claim 3 is dependent on claim 2, and further recites that the magnetic elements extend substantially from said first end of said process chamber to said chuck. It should be noted that claim 3 does not say that the plurality of magnetic elements are substantially disposed between, but instead extend from. Page 10, lines 28 to 32, and FIG. 2 of the application, as

cited above, also clarify that the "plurality of magnetic elements extend substantially from said first end of said process chamber to said second end of said process chamber to said chuck" means that the magnetic elements individually extend from one end to the other, not that a group of the magnets are disposed between one end and the other. In addition, Page 17, lines 16 to 18, of the application further states that the magnetic elements 550 are disposed along the plasma region, referring to FIG 6. None of the magnets in Dandl extend along the plasma region as recited in claim 3. Here the magnetic elements are in a ring shape as disclosed in Dandl. Instead of stating that the rings extend along the plasma region, the application states that they are disposed along the plasma region. Nothing in Dandle suggest extending a magnet from one end of the chamber to the chuck, as recited in claim 3. For these reasons, claim 3 is not made obvious by Dandl.

Claim 4 is dependent on claim 3. For these reasons, claim 4 is not made obvious by Dandl.

Claim 5 is dependent on claim 4 and further recites that each magnetic element has a physical axis which extends along the plasma region. The physical axes of the magnets of Dandl do not extend along the plasma region, as recited in claim 5. For these reasons, claim 5 is not made obvious by Dandl.

Claims 6 and 7 are dependent on claim 5. For these reasons, claims 6 and 7 are not made obvious by Dandl.

Claim 12 is dependent on claim 2. For these reasons, claim 12 is not made obvious by Dandl.

The Examiner rejected claims 8, 10-11, 13, and 15-16 under 35 U.S.C. 103 (a) as being unpatentable over Dandle in further view of Shan et al. (U.S. Patent 6,113,731) hereinafter Shan. The Examiner stated that Dandl does not disclose the magnetic elements are electromagnets and their rotation to shift the magnetic field over time, but that Shan discloses the use of electromagnets for generating an electrically rotated magnetic field in order to reduce damage of the substrate being processed and increase radial uniformity of the plasma process and that it would be obvious to combine Dandl and Shan to shift the magnetic field over time to optimize the process. The Examiner further states that Shan discloses that

electromagnets may be replaced by permanent magnets and it would have been obvious to use electromagnets in Dandl.

Claims 8 and 13 are dependent on claims 5 and 2, respectively, and further recites that the magnetic elements are electromagnets. *In re Vaeck* (20 USPQ2d 1438) states that “Where claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under § 103 requires, inter alia, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have reasonable expectation of success.” In addition, *Ex parte Clapp* (227 USPQ 972) states that “To support the conclusion that the claimed combination is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed combination or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the reference.” The applicant does not understand how the ring magnets 32 and 34 of Dandl could be successfully made from electromagnets. The Examiner has not pointed anything in Dandl or Shan that show how such ring magnets used in Dandl may be successfully made from electromagnets. For these reasons, claims 8 and 13 are not made obvious by Dandl in view of Shan.

Claims 10 and 15 are dependent on claims 5 and 2, respectively, and further recites moving at least one of the magnetic elements so that the magnetic field shifts over time. The Examiner cites Shan as teaching shifting the magnetic field over time to increase radial uniformity. It would not be obvious to combine the shifting of the magnetic field of Shan with Dandl. Dandl provides a radially uniform magnetic field, since the magnets are circular. For these reasons, claims 10 and 15 are not made obvious by Dandl in view of Shan.

Claims 11 and 16 are dependent on claims 5 and 2, respectively, and further recites where the magnetic elements are rotated. The Examiner cites Shan as teaching rotating the magnets to increase radial uniformity. It would not be obvious to combine the shifting of the magnetic field of Shan with Dandl. Dandl provides a radially uniform magnetic field, since the magnets are circular. For these reasons, claims 11 and 16 are not made obvious by Dandl in view of Shan.

The Examiner rejected claims 9 and 14 under 35 U.S.C. 103 (a) as being unpatentable over Dandle in further view of Ye et al. (U.S. Patent 6,178,920B1) hereinafter Ye. The Examiner stated that Dandl does not disclose the magnetic elements are individually contained within sleeves, but that Ye discloses magnetic elements contained in a non-sputtering jacket to prevent plasma from within the processing chamber from sputtering underlying material into the processing chamber and that it would be obvious to combine Dandl and Ye to place the magnetic elements in individual sleeves. Claims 9 and 14 are dependent on claims 5 and 2, respectively. For this reason claims 9 and 14 are not made obvious by Dandl in view of Ye.

The Examiner rejected claims 10-11 and 15-16 under 35 U.S.C. 103 (a) as being unpatentable over Dandle in further view of Tan et al. (U.S. Patent 5,795,451) hereinafter Tan. The Examiner stated that Dandl does not disclose that the magnetic elements rotate to shift over time, but that Tan discloses magnetic elements that are rotated to shift the magnetic field over time in order for a more uniform processing of the substrate and that it would be obvious to combine Dandl and Tan to mechanically rotate the magnetic elements.

Claims 10 and 15 are dependent on claims 5 and 2, respectively, and further recites moving at least one of the magnetic elements so that the magnetic field shifts over time. The Examiner stated that the motivation for combining Dandl with Tan is to provide a more uniform processing of the substrate. It would not be obvious to combine the shifting magnets of Tan with Dandl. Tan provides uniform processing by placing the substrate in the magnetic fields of the rotating magnets. The magnets of Dandl are placed to eliminate magnetic fields at the substrate. If the substrate in Dandl is not in magnetic fields, then there would be no reason to shift the magnets, since Tan uses the magnetic fields passing through the substrate to provide the uniform substrate. For these reasons, claims 10 and 15 are not made obvious by Dandl in view of Tan.

Claims 11 and 16 are dependent on claims 5 and 2, respectively, and further recites where the magnetic elements are rotated. The Examiner stated that the motivation for combining Dandl with Tan is to provide a more uniform processing of the substrate. It would not be obvious to combine the rotating magnets of Tan with Dandl. Tan provides uniform processing by placing the substrate in the magnetic fields of the rotating magnets. The magnets of Dandl are placed to eliminate magnetic fields at the substrate. If the substrate in

Dandl is not in magnetic fields, then there would be no reason to rotate the magnets, since Tan uses the magnetic fields passing through the substrate to provide the uniform substrate. For these reasons, claims 11 and 16 are not made obvious by Dandl in view of Shan.

New claim 26 is dependent on claim 2 and further recites that at least one magnetic element extends substantially from the first end of said process chamber to said chuck. This is supported on page 10, lines 30 to 32, and shown in figure 2. New claim 27 is dependent on claim 26 and further recites that the plurality of magnets are disposed around and outside of the periphery of the substrate. This is supported by page 10 and shown in figure 2. New claim 28 is dependent on claim 26 and further recites that the magnetic elements are placed to create a minimum magnetic field at the substrate. This is supported on page 15, lines 26 to 31, of the application. New claim 29 is dependent on claim 2 and further recites that each of the plurality of magnetic elements extends substantially from the first end of the process chamber to the chuck. This is supported on page 10, lines 30 to 32, and shown in figure 2. For these reasons the cited new claims 26-29 are not made obvious by the cited references.

The Examiner objected to the abstract. A new abstract has been submitted.

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at telephone number (831) 655-2300.

Respectfully submitted,
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CLEAN VERSION OF PENDING CLAIMS

1. (Cancelled)

2. (Once Amended) A plasma processing apparatus for processing a substrate, comprising:
a process chamber, comprising:
a wall defining part of the process chamber;
a device for igniting and sustaining within the process chamber a plasma for
said processing; and
a plasma confinement arrangement, comprising a magnetic array having a plurality of
magnetic elements that are disposed within said process chamber, said plurality of magnetic
elements being configured to produce a magnetic field, and wherein said plurality of
magnetic elements are disposed around and extend along said plasma region.

3. The apparatus, as recited in claim 2, wherein said plurality of magnetic elements extend substantially from said first end of said process chamber to said chuck.

4. The apparatus, as recited in claim 3, wherein said magnetic field has an azimuthally symmetric radial gradient.

5. The apparatus, as recited in claim 4, wherein each magnetic element has a physical axis which extends along the plasma region.

6. The apparatus, as recited in claim 5, wherein each magnetic element has a magnetic axis which is substantially perpendicular to the physical axis.

7. The apparatus, as recited in claim 5, wherein said magnetic elements are permanent magnets.

8. The apparatus, as recited in claim 5, wherein said magnetic elements are electromagnets.

9. The apparatus, as recited in claim 5, wherein said magnetic elements are individually contained within sleeves.
10. The apparatus, as recited in claim 5, wherein at least one of said magnetic elements is moved so that said magnetic field shifts over time.
11. The apparatus, as recited in claim 5, wherein said magnetic elements are rotated.
12. The apparatus, as recited in claim 2, wherein said magnetic elements are permanent magnets.
13. The apparatus, as recited in claim 2, wherein said magnetic elements are electromagnets.
14. The apparatus, as recited in claim 2, wherein said magnetic elements are individually contained within sleeves.
15. The apparatus, as recited in claim 2, wherein at least one of said magnetic elements is moved so that said magnetic field shifts over time.
16. The apparatus, as recited in claim 2 wherein said magnetic elements are rotated.
17. A method for controlling a volume of a plasma while processing a substrate in a process chamber, said chamber defined at least in part by a wall, using a plasma enhanced process, comprising:
producing a magnetic field inside said process chamber with a magnetic array located inside said chamber;
creating said plasma inside said process chamber; and
confining said plasma within a volume defined at least in part by said magnetic field.
18. The method, as recited in claim 17, further comprising the step of supporting the substrate on a chuck in the chamber, wherein the substrate is spaced apart from a first end of said process chamber, and wherein the plasma is substantially confined in a plasma region

between said first end of said process chamber and said substrate, and wherein said magnetic array, comprises a plurality of magnetic elements disposed around and extending along said plasma region between said first end of said process chamber and said substrate.

19. (Cancelled)

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Cancelled)

24. (Cancelled)

25. (Cancelled)

Sub 26
26. (New) The apparatus, as recited in claim 2, wherein at least one magnetic element extends substantially from said first end of said process chamber to said chuck.

27. (New) The apparatus, as recited in claim 26, wherein the plurality of magnetic elements are disposed around and outside the periphery of the substrate.

28. (New) The apparatus, as recited in claim 26, wherein the magnet elements are placed to create a minimum magnetic field at the substrate.

Sub 29
29. (New) The apparatus, as recited in claim 2, wherein each of the plurality of magnetic elements extends substantially from said first end of said process chamber to said chuck.